The New Free Rider Problem: How States Compete Over Gambling Revenues

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1 Introduction

"But if we proceed under these conditions, with care and transparency, I believe resort casinos can bring significant economic benefit to the Commonwealth with manageable impact on communities. Done the right way, resort casinos can join the many other reasons why Massachusetts is an international destination for travelers and tourists and a wonderful place to live." – Massachusetts Governor Deval Patrick, Sept 17, 2007

With these words, Governor Patrick concluded his statement which outlined his plan for three destination resort casinos in Massachusetts. There are many reasons behind the Governor's desire to seemingly go against his state's strong religious roots (although the Puritans did enjoy card games) and authorize gambling. Massachusetts desperately needs other sources of funds to reduce its billion dollar structural deficit and begin a billion dollar project to repair and maintain state roads and bridges. The state, however, is hesitant to increase already-high property, income, and sales taxes for financing (Ryan, 2007). In addition to the revenues gained from the casinos, the Governor predicts that the casinos will generate over 20,000 new jobs for state residents (Ryan, 2007). The casinos will lead to other economic development in the surrounding areas, with new hotels, restaurants, and other amenities accompanying the gambling facilities. These new developments will result in increased demand for construction companies as well. Each of these motivations is valid. One could argue, however, that the major reason behind Governor Patrick's initial authorization of the three resort casinos is to reclaim revenue. This reasoning ties in directly with the free rider problem.

The free rider problem is a social and economic issue relating to individual behavior in group settings. Free riding occurs when a group member contributes nothing or very little toward the cost of a good while still enjoying the full benefit of the good (Kim, 1984). Group members focus on their own individual utilities at the expense of the overall group utility. In the context of game theory, the choice to free ride proves to be the resulting Nash equilibrium. Whether or not

others in the group decide to pay their fair share, the dominant strategy for each individual would be to not contribute and benefit by free riding. The free rider problem is an issue across several areas. Some notable examples include defense, pollution, welfare, and labor unions.

A modern-day example of the free rider problem is in Massachusetts. The state is debating the decision to build casinos to reclaim revenues currently being spent in neighboring states, most notably Connecticut and Rhode Island. Ever since the Pequots' Foxwoods casino expanded to slot machines and table games in 1993, Bay Staters have flocked to the Ledyard, CT gaming facility. The strategy was so successful that Connecticut authorized a second resort casino, as Mohegan Sun opened in October 1996. Both casinos are strategically located just an hour south of the Massachusetts border, easily accessible from Rt. 395. Since the casinos offer services not provided in Massachusetts and are conveniently located, Connecticut is able to free ride, obtaining revenue from Bay State residents. It also gets visitors from New York and Rhode Island. Not only does the state benefit directly from the taxes passed on by the tribes due to increased gambling revenues, but it also receives indirect benefits from its other businesses in the tourism industry. Out-of-state gamblers eat at Connecticut restaurants, stay in hotels, and attend concerts and shows, each generating significant revenues with tax proceeds passing to the state. With the help of these visitors, Connecticut has become the fourth largest gambling region in the country (see Table 1.1). Another state to the south, Rhode Island, also draws Massachusetts residents to its two race tracks, Twin River and Newport Grand. The facilities both feature video lottery terminals, which were authorized in 1992. Combined, the two "racinos" feature nearly 6,000 slot machines, comparable to the number in each of the Connecticut casinos.

TABLE 1.1: Top 12 Highest Gambling Regions in 2006

Year	Revenue ($ billions)
Las Vegas Strip, NV	6.7
Atlantic City, NJ	5.2
Chicagoland, IN/IL	2.6
Connecticut	1.7
Detroit, MI	1.3
Tunica/Lula, MS	1.3
St. Louis, MO/IL	1.0
Reno/Sparks, NV	0.9
Boulder Strip, NV	0.9
Shreveport, LA	0.8
Biloxi-Gulfport, MS	0.8
Lawrenceberg/Rising Sun/Belterra, IN	0.8

Source: "Gulf Coast casinos hit revenue jackpot." USA Today 1 Aug 2007

One of the major issues in the gambling world is the resulting social problems that an addiction causes. Studies have shown that within a 50-mile radius of a casino, the social costs double, with increases in divorce rates, domestic violence, child abuse, rape, suicide, drug abuse, and bankruptcy (NGISC, 1999). As out-of-state gamblers do not reside in Connecticut, the state is not responsible for the social problems that these gamblers develop in the casinos. Thus, Connecticut is optimizing its economic position as a free rider. The state receives revenue from Massachusetts residents, but is not liable for the increased expenditures that must be provided for public health programs, public safety, and other impacts of the pathological gamblers.

A study by the Center for Policy Analysis at the University of Massachusetts Dartmouth attempts to quantify the spending by out-of-state residents. According to *New England Casino Gaming: Update 2007*, Massachusetts residents spent approximately $876.2 million in CY 2006 at Foxwoods and Mohegan Sun, generating a total of $118.8 million to the state of Connecticut

through the tax on tribal gambling revenues (Barrow, 2007). This figure attempts to account for both gaming and non-gaming revenues, including hotels, restaurants, shops, entertainment, and other attractions. Since these businesses must pay taxes on their revenue, the actual figure that Connecticut receives is even higher than reported after accounting for these supplementary activities. This alarmingly high number makes it apparent that Connecticut is acting as a free rider and benefiting from the lack of gaming competition from Massachusetts. Rhode Island also receives a significant benefit from Bay Staters. According to the same report, Massachusetts residents spent $179.5 million in CY 2006 at the two racinos, contributing approximately $100 million to the Rhode Island state treasury (Barrow, 2007).

This modern iteration of the free rider problem is unique in several ways. States are competing for the revenues of both in- and out-of-state individuals. These states are not attempting to conceal their intentions, as they build casinos right along the borders of neighboring states. The rules of supply-and-demand are in full force, with back-and-forth price changes between states to entice both visitors and new casino operators to their regions. It is a different spin on the free rider problem, which has historically focused on individuals free riding with other groups of individuals, or both individuals and corporations exploiting government agencies.

In order to explore the free rider problem in greater detail, this paper will examine similar situations in which states are competing over gambling revenues. Pennsylvania recently approved slot machines at five horse-racing tracks, the first of which were installed in November 2006. Within a year, the presence of slot machines has already had a significant effect on the gambling revenues in New Jersey and its Atlantic City gambling hub. In the Midwest, Indiana, Illinois, and Missouri have concentrated their casinos on one another's borders with the sole

intention of capturing revenue from the other states. There is also the added implication of Illinois's increase in taxes and the subsequent shift in gambling demand to Indiana and Missouri.

This paper attempts to answer three major questions. First, does the gambling market expand with the introduction of new casinos and gaming facilities in neighboring states? Second, are states successful in their efforts to reclaim revenues lost to neighboring states? What revenue gains do states truly achieve? Lastly, what are the effects of tax changes in a region with several states engaged in competition? In order to solve these questions, rigorous analysis of the monthly gambling revenues and tax income from every casino in NJ, PA, IL, IN, and MO since 2000 was essential.

After a thorough investigation, it can be concluded that the gambling market does in fact expand when new casinos are introduced in neighboring states. The combined revenues of the two markets should increase, as the casual gamers who do not travel out-of-state to gamble may increase their participation with a casino nearby. When executed correctly, states are not only able to reclaim a large portion of the revenue that was previously lost across state borders, but also gain more revenues from these casual gamers. Finally, the consequences to tax changes are significant and should not be ignored. Revenues can quickly shift across borders and benefit or harm rival states.

2 Literature Review

To date, there has not been extensive research on the free rider problem in the context of competition between states for gambling revenues. There have been several papers of note analyzing the free rider problem from various angles, including economic, sociologic, and ecologic approaches. In addition, there has been much written on the subject of gambling and the

related social costs. Within the literature review, both the relevant research on the free rider problem and specific gambling issues will be addressed.

The free rider problem has been debated for centuries, dating back to the ancient Greek philosophers. Plato addresses the issue within his *Republic*, as he argues against following the law if one can avoid the punishments for the violations. Adam Smith took an economics perspective in *Wealth of Nations*. Smith states that each producer "intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention… By pursuing his own interest he frequently promotes that of society more effectually than when he really intends to promote it" (Smith, 1776). Famed economist Vilfredo Pareto outlined the classic example: "If all individuals refrained from doing A, every individual as a member of the community would derive a certain advantage. But now if all individuals less one continue refraining from doing A, the community loss is very slight, whereas the one individual doing A makes a personal gain far greater than the loss he incurs as a member of the community" (Pareto, 1935).

In the twentieth century, many viewed the free rider problem as a minor issue. The prevailing opinion of economists was that the weighted sum of the positions by each group member determined the overall group action. This changed, however, in the second half of the century. Paul Samuelson defined public goods as those "which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good" (Samuelson, 1954). Inspired by this analysis of public goods, economist Mancur Olson first documented the modern free rider problem in the 1960s in *The Logic of Collective Action*. This was quickly followed by another perspective on the topic by ecologist Garret Hardin in "The Tragedy of the Commons." Both Olson and Hardin were

motivated to address this issue for different reasons. Olson focused on group behavior and individual actions in the economic sense, attempting to explain the decisions of group members based on different incentives. Hardin's area of interest was overpopulation, and his controversial pieces on topics such as abortion and immigration earned him criticism from both ends of the political spectrum.

Olson (1965) was the first economist to detail the behavior of individuals in group settings involving public goods. Olson immediately rejected the notion that individuals will work towards a mutual goal, stating "rational, self-interested individuals will not act to achieve their common or group interests." He used the example of a cartel, where it is in each producer's interest to collude and set high prices. Each producer, however, has the incentive to lower their own individual prices and gain the entirety of the market. With producers undercutting one another's prices, the cartel will disband, resulting in the optimal group outcome not being achieved. Labor unions are another important area where free-riders play a major role. Unions increase wages and improve working conditions for all workers. Workers have the incentive to not use the resources required to join the union, but still receive the same benefits. Legislation requiring membership in unions is one way to eliminate the free-rider issue in this setting. Olson also explained that smaller groups are more successful than larger groups, as social pressures and incentives play increased roles. Each individual accounts for a greater proportion of the group in a smaller organization, and one certainly finds it more difficult to free ride.

Contrary to Olson's economic approach, Hardin (1968) focused on the potential problem of overpopulation. After establishing that the optimal world population must be less than the maximum due to limited space and resources, Hardin used an example of herdsmen in a pasture. Each herdsman, seeking to maximize his or her own profits, will continue to add cattle to their

herd, even as the pasture quickly approaches the optimal capacity. The personal marginal benefit to the herdsman soon will be outweighed by the negative effect of overgrazing. Unfortunately, since the herdsman receives the entire positive effect and the negative effect is split among all members, the herdsman will rationally decide to add additional cattle. This "tragedy of the commons" is the free rider problem. As Hardin aptly states, "freedom in a commons brings ruin to all."

While there is little dispute over the theoretical merits of the free rider hypothesis, there have been several studies to test its empirical arguments. These studies generally consider two versions: a weak version asserting that the voluntary allocation of public goods will be below the optimal level, and a strong version stating that nearly zero public goods would be provided through voluntary contribution. Marwell and Ames (1981) performed twelve experiments in small group settings (32 individuals) to test the hypotheses. They found that people will voluntarily contribute a considerable amount of their resources to the provision of a public good (averaging between 40 and 60 percent of the total allocable resources). This contradicts the "strong" version of the free rider hypothesis, as only an allocation close to zero would justify this. Free riding does exist, as the total allocation is below the public optimum of 100 percent. With this allocation between the Pareto efficient level and the free riding level, the results support the "weak" version of the hypothesis.

Andreoni (1987) questioned why the results of empirical studies do not correctly match the predictions of the theoretical hypothesis. Repeated trials were often necessary for participants to behave in free riding patterns. The two major explanations for this decay are the learning hypothesis and the strategies hypothesis. The learning hypothesis represents the tendency to choose the natural Nash equilibrium, as the participants learn over time that the free riding

behavior is the dominant individual strategy. The strategies hypothesis considers the asymmetrical information between the subjects, as they may contribute to the public good early in the game to generate goodwill before free riding in the later rounds. Following ten iterations of the single-shot experiment, the results contradicted both the strategies and learning hypotheses. Andreoni attempts to explain decay through the difference in decision-making processes, the struggle to establish a norm, and Regret Theory, in which those who unexpectedly succeed will continue to make the same decisions, while those who do worse than expected change their allocation, resulting in a slow decay.

In contrast to the experiments by Marwell and Andreoni, the results from a study by Kim and Walker (1984) supported the free rider hypothesis. The authors disputed the experimental design by other researchers, instead insisting that one must carefully create a situation in which the free rider problem would be applicable. Their study consisted of just five participants who faced a decision on how much to contribute to the group fund. After studying the previous research, Kim very carefully set up a scenario that eliminated what he labeled "invalidating factors." The choices by the participants supported the "strong" version of the free rider problem. The authors conclude by stating that the free rider hypothesis should not be rejected, as the presence of invalidating factors is the cause for the failure from the research of others.

Walker (1999) provided an examination of the social costs of gambling by analyzing past studies and estimates. The author disputes prior estimates of total costs per pathological gambler, which range from a "conservative $9,000 to over $50,000 per person" (Walker, 2007). These costs are typically estimated from surveys of Gamblers Anonymous, the most heavily addicted gamblers. Many of the studies consider wealth transfers (i.e. bad debts, bankruptcy, unemployment, welfare) in their calculations. While the transfers reduce the wealth of the

gambler, they do not change the overall wealth of society and therefore cannot be considered social costs. It is also impossible to allocate social costs for those individuals with multiple addictions or disorders. After accounting for these various difficulties, Walker estimates the annual social cost per pathological gambler to be $2,974. This figure is contingent on gambling being the primary disorder, as comorbidity would certainly reduce the social cost allocation to gambling. In his later paper, Walker used a different study and obtained an annual figure of $2,049, which he adjusted down to $881 per pathological gambler to account for the heavy gamblers in the surveys. The author acknowledged that all social cost estimates are imprecise, with too many assumptions to provide an accurate figure.

While addressing the various benefits of gambling to society, Walker touched on the tax issue as another example of a wealth transfer which does not generate real value. However, when "…casinos are located on state or country borders, much of the tax revenue may accrue from outsiders. In this case, the tax revenue can be counted as a benefit to the local population, who may see their tax burdens decrease as a result of tourism and the associated tax revenues" (Walker, 2007). Other benefits include potentially increased employment, an increasing choice of entertainment for consumers, and lower market prices due to increased competition and the respective increase in consumer surplus.

3 Data and Methodology

One advantage of investigating the gambling industry is the availability of data. Each state has its own gambling commission which releases monthly financial data for each casino. These monthly figures are very valuable sources of data and are essential to the econometric model. In all, data from five different states (PA, NJ, IN, IL, MO) was collected and analyzed.

There are several important gambling terms that must be defined. The *handle* refers to the total amount of money wagered by customers, not factoring in payoffs by the casino. The *adjusted gross revenue* (or AGR) is the handle (total amount wagered) less the total amount the casino paid out. AGR will often be referred to as a casino's "revenue" in the following analysis. Casinos also pay *taxes* to the state government as part of their agreement. There are two main types of taxes: admissions taxes and wagering taxes. An admissions tax is a specified tax on each visitor to the casino (often $2 or $3). Wagering taxes are a proportion of the casino's win (AGR) that must be paid to the state. The wagering tax can be flat or graduated based on the level of AGR. The two most important figures, AGR and tax, were collected for each casino each month.

The first important hypothesis was whether or not the gambling market expands with the addition of new gaming facilities in neighboring states. To address this question, the combined size of the overall gambling market in the target areas must be analyzed in comparison to the market size prior to the new facilities. For instance, we must combine the New Jersey and Pennsylvania markets to determine the change in the total market. To quantify this change, a dummy variable is introduced to signal the beginning of gambling in the rival state. If this dummy variable proves to be positive at a statistically significant level, then there is a degree of confidence that the overall market has expanded with the introduction of new casinos. In order to further analyze this question, New Jersey casino revenues were forecasted in 2007, the year following the introduction of Pennsylvania slots. These forecasts were based on trends from each state casino over the period of 2000 to 2006. Next, the actual summed Philadelphia and New Jersey revenues were compared to the forecasted revenues, which represent predicted AGR with no addition of Pennsylvania. If the actual revenues prove to be greater than the forecasts, then the market has expanded.

The second major question involved whether or not states are successful reclaiming revenues from their neighbors. Again, Pennsylvania's clash with Atlantic City proves to be a prime example. By comparing forecasted revenues to actual revenues for New Jersey, it quickly becomes apparent whether or not the state is gaining or losing customers. If the revenues are in fact less than the forecasted estimates, it is likely that Pennsylvania residents who previously crossed the border to gamble in New Jersey are now staying in-state. This could be especially true in this particular scenario, as Pennsylvania's largest city, Philadelphia, is located just an hour from Atlantic City.

The final hypothesis for exploration investigated the effects of tax changes on a region. The Midwest states of Indiana, Illinois, and Missouri continue reacting to multiple tax changes in the region. The variable 2002 represents the various tax changes that went into effect beginning July 1, 2002. Likewise, the variables 2003 and 2005 represent tax changes effective July 1 of the respective year. In order to determine the magnitude of the effects on each state, regressions were run for each casino and region. The dependent variable is monthly AGR, while independent variables include monthly trend and dummy variables corresponding to the year that each tax change went into effect. The dummy variables for the tax changes switch "on" in the month that the change first takes effect (July 2002 for the 2002 dummy variable) and stay "on" for the duration of the investigated time period. Therefore, these variables capture the differential effects of the tax changes during each of their respective periods. The coefficients for each of the dummies signify the extent that the tax change affected revenues in each period. Percentage change can also be derived from the quotient of the coefficients and the forecasted revenue in the month the tax change first went into effect. In addition to analyzing the effects of the tax changes on a state-wide level, each individual casino and its respective region was scrutinized.

One major consideration when analyzing gambling revenues is seasonality. Gambling revenues increase significantly in the spring and summer months before dropping off during the fall and winter, often differing by 20%. In the case of the Resorts Atlantic City Casino, revenues in July were often 50% higher than revenues in December. When performing time-series trend analysis with monthly data, it is essential to account for these seasonal differences. Therefore, the data was seasonally decomposed multiplicatively. Multiplicative decomposition was utilized because both the New Jersey/Pennsylvania and Midwest regions have positive trends, making multiplicative decomposition more appropriate than additive decomposition.

4 Results

This section will involve an analysis of the current state of the two major battlegrounds for gambling revenues: New Jersey vs. Pennsylvania and the three-way clash involving Illinois, Indiana, and Missouri. In addition to a short history of gambling within the regions, we will examine the effects of various changes to the region and consider how the results relate to the major questions concerning the free rider problem.

New Jersey vs. Pennsylvania

History

Gambling has been associated with New Jersey since 1976, when a state referendum was passed by voters. The measure restricted casino gambling to Atlantic City and promised to use tax revenues on programs to assist the elderly and handicapped. New Jersey's rationale included the potential for "substantial revenues" while also revitalizing Atlantic City, an area which had fallen on hard times (New Jersey Gambling Study Commission, 1973). Two years later, the Resorts Atlantic City was the first casino to open. As the only place aside from Las Vegas

offering legal gambling, Atlantic City fought to be an intriguing travel destination for those on the East Coast less willing to fly cross country, but it has never been able to emulate the experience of the Las Vegas Strip. Casinos have stricter limits on hours of operation and payoffs compared to their Nevada counterparts. Also, the non-gaming shows and events that define Vegas are not replicated, although the rise of Mike Tyson in the 1980s led to increased popularity due to his Atlantic City bouts. Even without perfectly replicating Las Vegas, the eleven casinos earned $4.9 billion in AGR during 2007, trailing only the Vegas Strip. The private casino operators are taxed on their total AGR, with 8% going to the Casino Revenue Fund, which supports regulation and other state purposes and 1.25% going to the Casino Reinvestment and Development Authority, which assists urban development. In 2007, the two funds received over $450 million.

Philadelphia, the sixth largest city in the United States with a population of over 1.4 million, sits just an hour from Atlantic City. For years, this has been an excellent source of revenue for the New Jersey casinos, for the short drive down the Atlantic City Expressway was the closest gambling destination. Harrah's estimated that in 2003, Pennsylvania's nine million residents made over 7.7 million gambling trips (Harrah's Survey '04). In 2004, frustrated with the prospects of annually losing hundreds of millions to their eastern neighbor, Pennsylvania approved slots gambling throughout the state to raise funds for public education and senior citizens (Pennsylvania Gambling Control Board). Further, the state announced in 2006 an additional fourteen licenses for slot parlors, adding 61,000 machines. Although a significant threat, New Jersey reacted optimistically to the news. Jeff Vasser, Director of the Atlantic City Convention & Visitors Bureau, viewed the introduction of slots as "an opportunity…Let them try the slots in Pennsylvania, then come to where the big boys play [in Atlantic City]" (Sumner,

2004). This is similar to how Las Vegas reacted to the proliferation of Indian gaming in California. In November 2006, Mohegan Sun at Pocono Downs became the first race track to open a slots parlor. At the end of 2007, there were six facilities operating with five more scheduled to open in 2008. Although just two casinos were open for the entire year, the facilities exceeded $1 billion in AGR. Compared to their eastern counterparts, the operators are heavily taxed. This tax includes 34% to the state, 12% to the Penn Race Horse Development Fund, 5% to Gaming Economic Development and Tourism, and a 4% local tax. With a total 55% tax rate on the slot revenues, the state of Pennsylvania earned $571 million in 2007, exceeding New Jersey's total in its first full year of operations.

Market Expansion

The introduction of the Pennsylvania slots had a significant impact on the regional gambling market. Using NJ revenue data since 2000 and adjusting for seasonality, a regression attempting to explain the total state revenues for the combined NJ and PA region indicates that revenues have increased by an average of $57.1 M per month since Pocono's first full month of operations in December 2006 (see Table 4.1). This simple model shows the major effect that the PA slots had on the region.

TABLE 4.1: NJ/PA Gambling Market from 2000 to 2007
Estimated Equation: Monthly NJ + PA Revenues = $\alpha + \beta_1$ intropa + β_2 t + ε_i

Years	α	β_1	β_2
2000-2007	337.6	57.1**	1.1**
	(42.6)	(9.2)	(14.8)

Coefficients in $ millions. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
Multiplicative seasonal decomposition adjusted the data for monthly seasonality.
intropa is a dummy variable; intropa = 0 prior to Dec 2006, intropa = 1 from Dec 2006 on.
t is the trend; t = 0 for January 2000, t = 96 for December 2007.

Although the entire state of PA benefitted from the introduction of gambling, the most direct competition over revenues involves the two Philadelphia race tracks. Harrah's and Philadelphia Park are located much closer to Atlantic City than the four other facilities that were open by the end of 2007 (see Table 4.2). Therefore, these two casinos were used to approximate Pennsylvania's share in the regional gambling market. Philadelphia Park opened in December 2006 and had its first full month in January 2007, and Harrah's Chester Downs opened in January 2007 with its first full month in February 2007. The combined revenues of Philadelphia Park and Harrah's Chester Downs will represent Pennsylvania's in future regression and forecasts with New Jersey. A second regression which sums New Jersey and Philadelphia slot revenues to represent the total market revealed that the revenues of the region increased by $15.3 M on a monthly basis following the introduction of the Philadelphia slots in Jan 2007 (see Table 4.3).

TABLE 4.2: Pennsylvania Facility Distances from Atlantic City, NJ

Year	Miles
Harrah's Chester Downs	71
Philadelphia Park	79
Mount Airy Resort & Casino	167
Mohegan Sun at Pocono Downs	172
Meadows	378
Preque Isle Downs	480

NOTE: Distances estimated from Google Maps

TABLE 4.3: NJ/PA Gambling Market from 2000 to 2007
Estimated Equation: Monthly NJ + Philadelphia Revenues = $\alpha + \beta_1$ introphil + β_2 t + ε_i

Years	α	β_1	β_2
2000-2007	336.9	15.3*	1.2**
	(89.7)	(2.4)	(15.2)

t-statistics in parentheses. Figures in $ millions. * sig at 5%. ** sig at 1%.
Multiplicative seasonal decomposition adjusted the data for monthly seasonality.
introphil is a dummy variable; introphil = 0 prior to Jan 2007, introphil = 1 from Jan 2007 on.
t is the trend; t = 0 for January 2000, t = 96 for December 2007.

Forecast Summary

In order to estimate the effect of the introduction of the PA slots on each NJ casino, 2007 revenues for each of the eleven casinos were forecasted using monthly data from 2000 to 2006. Although the first PA facility opened in mid-November 2006, Pocono Downs is located three hours away from Atlantic City. The second operator, Philadelphia Park, opened December 19, 2006 and is located just an hour away. Since Philadelphia Park provides a better indicator of the competition with Atlantic City, the most appropriate month to begin the forecasts was January 2007. Tables 4.4 and 4.5 exhibit the forecast results on a casino and monthly basis. See Appendix D for sample forecast calculation for the AC Hilton.

TABLE 4.4: 2007 Forecast of New Jersey Casino Revenues by Casino
(figures in $ millions)

Casino	Actual	Predicted	Difference	%
AC Hilton	304.9	298.6	6.3	2.1
Bally's AC	641.4	653.6	-12.2	-1.9
Borgata	751.0	806.6	-55.6	-6.9
Caesars	583.3	552.6	30.7	5.6
Harrah's Marina	519.5	513.7	5.8	1.1
Resorts	278.7	283.5	-4.8	-1.7
Showboat	407.4	438.3	-30.9	-7.0
Tropicana	403.7	422.9	-19.3	-4.6
Trump Marina	241.9	251.5	-9.6	-3.8
Trump Plaza	280.3	299.3	-19.0	-6.3
Trump Taj Mahal	508.6	511.0	-2.5	-0.5
Totals	**4,920.8**	**5,031.6**	**-110.8**	**-2.2**

NOTE: Predicted revenues forecasted using monthly data from 2000 to 2006.

Overall, the Atlantic City casinos performed 2.2% worse than forecasted. Eight of the eleven casinos performed below predictions, averaging 4.1% below expectations. Three of the casinos exceeded expectation, averaging 2.9% above their predicted level.

TABLE 4.5: 2007 Forecast of New Jersey Casino Revenues by Month
(figures in $ millions)

Month	Actual	Predicted	Difference	%
January	394.5	378.3	16.2	4.3
February	378.3	388.4	-10.2	-2.6
March	438.3	416.2	22.0	5.3
April	396.8	414.6	-17.8	-4.3
May	408.8	428.1	-19.3	-4.5
June	419.8	419.3	0.5	0.1
July	469.6	485.4	-15.8	-3.3
August	465.2	484.5	-19.3	-4.0
September	419.3	429.1	-9.8	-2.3
October	384.4	410.7	-26.3	-6.4
November	374.7	400.2	-25.5	-6.4
December	371.2	376.8	-5.6	-1.5
Totals	**4,920.8**	**5,031.6**	**-110.8**	**-2.2**

NOTE: Predicted revenues forecasted using monthly data from 2000 to 2006.

On a monthly basis, the difference between the forecasted and actual revenues varied significantly. In March, casinos performed $22.0 M (5.3%) better than predicted, while in October, the facilities earned $26.3 M (6.4%) less than expected. In total, the casinos fared worse than forecasted in nine of the twelve months, including the final six months of the year. On average, Atlantic City earned $9.2 M (2.2%) below the predicted revenues per month. The annual growth in revenues for New Jersey not only declined, but was actually negative during 2007. Atlantic City received over $5.2 billion during 2006, the highest figure ever for the state. This amount dropped to $4.9 billion in 2007, a decline of 5.7% (see Table 4.6). This decrease is more pronounced than the predictions due to the November 2006 closing of the Sands, which was not included in the forecasts. The closing of the Sands may have also suppressed the $15.3

M coefficient in the Table 4.3 regression, as the opening occurred around the same time as the loss in revenues from the Sands. Regardless, New Jersey was certainly harmed by the Pennsylvania slots, as it earned $27.5 million less in casino tax revenues in 2007 and likely incurred more losses in non-gaming entertainment revenues.

TABLE 4.6: New Jersey Annual Growth Rates from 2001 - 2007

Year	Growth Rate (%)
2001	0.1
2002	1.8
2003	2.4
2004	7.1
2005	4.4
2006	4.0
2007	-5.7

NOTE: Growth rates calculated from reported annual NJ casino revenues

Focus on Philadelphia Slots

In order to determine the change in the overall gambling market, the differences in NJ revenues were compared to the revenues earned by the PA facilities in each month of 2007. From Table 4.2, it is apparent that the two Philadelphia facilities provide the main competition against Atlantic City. After the first two months of January and February, combined revenues exceeded $46 M in each subsequent month of 2007. Table 4.7 compares the monthly gambling revenues of the two Philadelphia race tracks to the difference between actual and forecasted revenues of the NJ casinos from Table 4.5.

TABLE 4.7: 2007 Monthly Expansion of New Jersey / Pennsylvania Gambling Market
(figures in $ millions, except for percents)

Month	Difference	Phil. Revenue	Expansion	%
January	16.2	30.8	47.0	12.4
February	-10.2	39.8	29.6	7.6
March	22.0	47.6	69.7	16.7
April	-17.8	46.8	29.0	7.0
May	-19.3	47.8	28.5	6.7
June	0.5	48.9	49.4	11.8
July	-15.8	54.3	38.5	7.9
August	-19.3	52.3	33.0	6.8
September	-9.8	51.8	42.0	9.8
October	-26.3	52.0	25.7	6.2
November	-25.5	48.2	22.7	5.7
December	-5.6	50.7	45.2	12.0
Totals	**-110.8**	**571.0**	**460.2**	**9.1**

Difference: Actual NJ revenues less Forecasted NJ revenues (see Table 4.5)
Phil. Revenue: Revenues from the two Philadelphia casinos
Expansion: The actual market size less the forecasted NJ revenues
%: Percent the expansion exceeds forecasted NJ revenues

The revenues in Philadelphia exceed the differences in actual and predicted revenues in Atlantic City for each month of 2007. More simply, the total actual revenue in the gambling market of Atlantic City and Philadelphia exceeds the expected NJ revenues with no introduction of gambling in Pennsylvania. The gambling market has expanded.

The greatest difference expansion over the predicted NJ revenues occurs in March, as the actual market gained $69.7 M (16.7%) more than the forecasted figures. The lowest difference of $22.7 M (5.7%) occurred in November, a month in which the Atlantic City casinos struggled. In total, the gambling market expanded by an average of $38.3 M per month during 2007. Coupled

with the decline in NJ revenues, it is safe to say that PA was successful in reclaiming some of its revenues that were previously lost to Atlantic City.

Potential Issues with Forecast Model

The results from the forecast model certainly indicate that the gambling market encompassing New Jersey and Philadelphia expanded. However, there are some potential issues with this forecast model. The choice of 2000 as the year to begin the forecast was arbitrary and could be altered. Is seven years of data too many to use when attempting to forecast 2007? The period of 2001 to 2003 was a time of slow growth for Atlantic City, while growth picked up from 2004 to 2006, exceeding 4% in each year. Since the data began in 2000, the model forecasted a $0.5 M increase in gambling revenues for each month of 2007, a growth rate of approximately 2% year-over-year. Casino revenue declined in every relevant state in 2007 (see Table 4.8). In Connecticut, perhaps the best proxy as a Northeast state, revenues dropped 2.9% after a 3.0% increase during 2006. However, CT may have also been affected by the introduction of Pocono Downs, located four hours from the two CT casinos, as well as increased competition from New York. Since it appears that 2007 was a down year for gambling across the country, possibly due to the slumping economy during the latter part of the year, a forecasted 2% growth rate in NJ appears reasonable. Thus, data from 2000 onwards was appropriate to use in the model.

TABLE 4.8: Revenue Growth Rates 2005 - 2007
(growth rates in %)

Year	2005	2006	2007
NJ	4.4	4.0	-5.7
CT	2.3	3.0	-2.9
IN	1.9	6.8	1.8
IL	4.8	6.9	3.1
MO	4.0	3.9	0.0

NOTE: Growth rates calculated from reported annual state casino revenues

The Future

Since the Pennsylvania slots have only been in place for one year, it will be very interesting to see what the future holds for this region. These slots are currently taking away a significant amount of money from New Jersey. As the state expands its casino offerings and begins to offer table games, will additional Atlantic City gamblers be persuaded to come to Philadelphia? Since only one year has passed, 2008 will be a very interesting year.

There are also questions relating to the types of casinos that come to Pennsylvania. If the casino operators in Atlantic City build casinos across the border in PA, there will be ample opportunities for cross promotion. Casinos will encourage patrons to visit their sister facilities across state borders. Another important consideration is the different tax rules in place, as the 55% tax in PA far exceeds the 9.25% levy assessed in NJ. The NJ casinos keep considerably more of their revenues than PA casinos, and therefore have additional funds to spend on extra benefits for guests, marketing, expansions, and infrastructure improvements. This could add another dimension to the battle for revenues, with specific casino operator potentially included as a major differentiating factor along with state and distance.

Illinois and the Midwest

History

Midwest gambling has taken a different course than its counterparts on the East and West Coasts. Instead of legalizing gambling in a specific area, Midwestern states began their foray into gambling through authorization on excursion boats. In 1989, Iowa became the first state to allow its counties to vote via referendum on riverboat proposals. In 1991, the first vessel sailed on the Mississippi for a specified period of time (often two hours) and had strict loss limits ($200 maximum per day) and wager limits ($5 per hand). Other states quickly followed Iowa's lead, as Indiana, Missouri, and Indiana each legalized riverboat gambling by 1993.

Competition between the various states has been fierce. The majority of the vessels within the region are located right on the border of another state, enticing patrons to cross state lines and giving the state an opportunity to free ride. States not only compete on casino location, but also on their different rules and regulations, as well as the amenities the riverboats offer. Therefore, states must react quickly to changes. For example, Iowa revenues began to decline following the rapid legalization of gambling in several Midwest states. The state leaders realized that its patrons were voyaging instead to Indiana, where there were no restrictions on its guests. Iowa promptly voted to eliminate its wager and loss limits, while also allowing 24-hour gambling (Iowa Racing and Gaming Commission). In response to tightening competition, Illinois changed their laws in 1999 to allow the riverboat casinos to operate while permanently docked (P.A. 91-40). Perhaps the major form of competition occurs due to amenities that the different riverboats can offer. Casinos entice their best customers to return by offering free drinks, dinner, lodging, and entertainment options. The scope of amenities that a casino can offer

is tied to their share of the revenues, which is directly related to a state's tax of gambling takes, one of the Midwest's most controversial issues this decade.

Tax Rate Changes

Most states began with a flat tax on adjusted gross revenues (AGR) coupled with an admissions tax based on the number of visitors. Illinois was the first state to switch to a graduated tax structure on AGR in 1998. A major problem with graduated tax rates is that this structure discourages investment and growth for the casino: the more revenue a casino earns, the higher the marginal tax rate on these additional proceeds. Vital investments such as new technologies, marketing, and the construction of non-gaming amenities are often overlooked, while layoffs and fewer job offerings are almost unavoidable (Missouri Gaming Commission, 2005). This tax policy rewards smaller casinos with lower tax rates, even though these facilities risk less with their smaller-scale operations, generating less economic benefit and creating fewer jobs.

Since casinos receive less of the revenues with higher tax rates, they must pass this burden to their customers. Patrons may receive less of the amenities that they came to expect from before. The casinos cannot change the payoffs of the slots or table games as these are federally regulated, but they could raise prices on other entertainment options and travel fees. These changes directly impact the experience of the gambler, who may decide that another facility in another state may prove to be a better option. With the highest tax rates, Illinois casinos risk losing customers in this manner. Thus, it is possible that a state could receive less tax dollars even with the higher rates if enough customers leave and AGR declines. Furthermore,

a new administration may subsequently reduce taxes to prior levels, but the damage may already be done and lost patrons may not be recoverable.

In 1998, Illinois adopted a graduated tax structure with a maximum rate of 35% on AGR in excess of $100 M for the year (see Appendix C for detailed tax structures for each state). The economic slowdown in 2001 forced cash-strapped states to reconsider their tax policies, and in 2002 both Illinois and Indiana adjusted their rates. Illinois increased taxes within each bracket, including raising their maximum tax rate to 50% on AGR in excess of $200 M. Four of the nine casinos fell into this category, although each casino was affected by the increase. The state also raised the admissions tax 50% from $2 to $3. Effective tax rates rose from 31% in FY2002 to 38% in FY2003 (see Table 4.9). Prior to the 2002 change, Indiana had levied a flat 20% tax on AGR, including a $3 tax per admission. In an attempt to recoup more revenues, the state adopted a graduated tax structure with a maximum rate of 35% on AGR above $150 M. Five of the ten casinos faced taxes at this highest marginal rate. The effective tax rate only increased from 27% to 31%, a change far below that of their western neighbors. Therefore, the Indiana change in structure will not be labeled a major tax increase on the level of Illinois. Missouri continued its flat tax of 20% on AGR and $2 tax per admission, an effective rate of 28%. The next year, Illinois again increased its rates, with the maximum rate increasing to an extreme 70% on AGR above $250 M (only the Grand Victoria Casino Elgin reached this highest bracket). This raised the state's effective tax rate to an astronomical 46% in FY2004 and 47% in FY2005. Although the tax increase expired in 2005 and rates retreated to 2002 levels with effective rates of 38%, one must question whether patrons were lost across state borders due to the certain cutback in amenities by the riverboats.

TABLE 4.9: Effective Tax Rates from FY2001 to FY2007
(tax rates in %)

Fiscal Year	Illinois	Indiana	Missouri
2001	30.9	26.8	29.0
2002	31.2	26.7	28.1
2003	38.0	31.1	27.8
2004	46.3	32.1	27.5
2005	46.7	32.2	27.2
2006	37.7	32.3	26.9
2007	38.4	32.2	26.4

NOTE: FY200x ends on June 30, 200x and begins July 1 of prior year
Effective tax rate = total taxes / total AGR

Region Analysis

Since Illinois has had the most substantial change in its tax structure, it is essential to analyze the changes in revenue in both Illinois and the surrounding states (see Table 4.9). Monthly gambling revenues in Illinois, Indiana, and Missouri were collected for analysis. The revenues are seasonal in nature, so a multiplicative seasonal decomposition was utilized, as the region's AGR exhibited a positive trend. After decomposition, regressions were performed on the revenues with four independent variables: a trend variable (enumerating the 96 months from January 2000 to December 2007) and three dummy variables for the three Illinois tax increases (2002, 2003, and 2005). There are three major battleground regions surrounding Illinois: Northeast (Illinois vs. Indiana), Southwest/St.Louis (Illinois vs. Missouri), and South (Illinois vs. Indiana vs. Missouri). In addition, there is one Illinois casino in the Central (Peoria) and Northwest regions (Rock Island). Of the state's total AGR in 2007, these regions make up just 6.7% and 1.8%, respectively. The Rock Island casino does compete with various Iowa casinos;

however, since revenues are so small at Rock Island (less than $4 million per month), the Iowa competitors were not considered in this model. Also, eleven Native American tribes in Wisconsin offer gambling at twenty-three different locations throughout the state. Wisconsin does not publish revenues from its Indian gaming locations, and since there are no Illinois casinos located on the northern border, Wisconsin revenues will not be considered in the model. Each region was analyzed on a casino, state, and overall basis to determine the effects of each tax change.

FIGURE 4.10: Midwest Region Gambling Map (Illinois Gaming Board, 2006)

Several changes were made to the data set. Two casinos which opened after the 2005 tax increase were removed from the sample. Both of these casinos, the French Lick Resort Casino in Indiana and the Lumiere Place Casino in St. Louis, MO, confounded the results, as they added

very little to the analysis of the various tax changes. In addition, adjustments were also made to the Caesars Indiana in Elizabeth, IN, which was temporarily closed for ten days in January 2005 due to flooding. In an alternate regression, a dummy variable created to represent this month attributed $7.7 M of the decline to the flooding. In order to more accurately reflect Caesars revenues, this $7.7 M was added to the total in January 2005. Another possible alteration would be to the Ameristar St. Charles Casino in St. Louis, MO, which underwent significant expansion that was finalized in August 2002. Revenues increased from $14.4 M to $22.2 M in just one month, a 54% increase. After adjusting using an alternate regression, the expansion was responsible an increase of $6.4 M per month at Ameristar. However, revenues at the other St. Louis casinos declined during this month, indicating that the expansion drew visitors that were previously at the other venues. By controlling for the increase, overall Missouri revenues would be understated. Therefore, no dummy variable was created to control for the expansion (see Appendix G for Caesars and Ameristar regressions).

Overall Effects of Tax Changes

Table 4.11 summarizes the effects of each of the three IL tax changes (2002, 2003, and 2005) on each of the three states within the region (IL, IN, and MO) and the overall region (see Appendix E for sample regression calculation):

TABLE 4.11: Independent Variable Summary for IL, IN, MO from 2000 to 2007
Equation: state revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	IL	IN	MO	Total
α	136.2	141.1	83.8	361.2
β_1	0.6**	0.6**	0.5**	1.7**
t-stat	(11.1)	(6.4)	(8.4)	(9.3)
m7	105%	106%	104%	105%
β_{2002}	-8.6**	16.3**	5.9**	13.6*
t-stat	(4.7)	(5.0)	(2.8)	(2.2)
%	-5.6%	8.8%	5.3%	3.0%
β_{2003}	-18.6**	5.9	3.2	-9.4
t-stat	(-10.5)	(1.9)	(1.6)	(-1.5)
%	-13.1%	2.9%	2.7%	-2.0%
β_{2005}	2.6	-3.8	-3.8	-5.0
t-stat	(1.4)	(-1.2)	(-1.8)	(-0.8)
%	1.6%	-1.8%	-3.0%	-1.0%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

At the beginning of the period, IL and IN had comparable total gambling revenues, independent of any tax changes, as their coefficients are similar to one another. MO's revenues are approximately 40% less than that of its two eastern neighbors. Each state had a positive trend (β_1) from 2000 to 2007, indicating that revenues are rising. After the monthly increases are annualized, the states are each gaining more than $6 million in AGR each year, resulting in an additional $20.9 million for the region. Upon analysis of the 2002 tax increases by IL and IN, it is evident that it had significant, but opposite effects on the states. IL revenues declined $8.6 M (-5.6%) per month due to their tax increase. Remarkably, IN increased their revenues by $16.3 M (8.8%) per month even while raising the effective tax rate from 27% to 31%. MO also seemed to

benefit from the tax increase, with revenues remaining increasing $5.9 M (5.3%), although this revenue increase could be partly explained by the expansion at the Ameristar St. Charles Casino in St. Louis. Powered by IN's increase, the three-state region increased its revenue by $13.6 M (3.0%), although this was not statistically significant at the 5% level.

The 2003 tax increase had a substantial impact in IL, as effective taxes soared from 38% to 46%, dwarfing the 32% and 28% rates in IN and MO, respectively. The effects on revenue supported this claim. IL lost an estimated $18.6 M in potential revenue per month due to the tax increase, a 13.1% decline. IN was the main beneficiary, with revenues increasing $5.9 M (2.9%) each month. MO revenues also grew by $3.2 M (2.6%). The entire region lost $9.4 M (2.0%), although again this figure was not statically significant.

In 2005, IL again altered their tax rates, decreasing their effective tax rates to 38% after peaking at 47% in FY2004. However, this did not have a significant impact on IL's revenue declines, as the state recovered just $2.6 M (1.6%) from their 2003 tax increase. IN revenues dropped $3.8 M, but remained ahead of their standing following the 2002 tax change. Finally, revenues in MO declined $3.8 M. The region in total reported a $5.0 M (1.0%) loss. The effects of the 2005 tax decrease by IL justify the argument that once taxes are increased and amenities disappear, lost customers may be irrecoverable. It is also possible that once the tax rates dropped, IL riverboats did not restore the amenities from before, perhaps fearing another tax increase.

In addition to analyzing the results drawn from the entire states of IL, MO, and IN, it is also important to exclusively consider the region surrounding IL where the most intense competitive battles occur. Table 4.12 below shows the same analysis specifically for the IN and MO casinos that compete on the border of IL.

TABLE 4.12: Independent Variable Summary for **Relevant** IL, IN, MO from 2000 to 2007
Equation: state revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	IL	IN	MO	Total
α	136.2	98.6	37.3	272.1
β_1	0.6**	0.4**	0.2**	1.2**
t-stat	(11.1)	(5.2)	(6.5)	(8.7)
m7	105%	105%	103%	105%
β_{2002}	-8.6**	13.1**	2.9**	7.5
t-stat	(4.7)	(5.4)	(2.7)	(1.6)
%	-5.6%	10.1%	6.1%	2.3%
β_{2003}	-18.6**	4.0	3.6**	-11.0*
t-stat	(-10.5)	(1.7)	(3.5)	(-2.5)
%	-13.1%	2.9%	6.7%	-3.3%
β_{2005}	2.6	-1.8	-1.4	-0.6
t-stat	(1.4)	(-0.8)	(-1.3)	(-0.1)
%	1.6%	-1.3%	-2.4%	-0.2%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

Since the same ten IL casinos are included in the analysis, the results from IL remain identical to Table 4.11. However, there are changes to both the IN and MO results. The size of the market in both states is less, as only the relevant border casinos are included. Following the IL tax increases in 2002 and 2003, the border casinos in both states exhibited higher gains on a percentage basis than the state-wide results. Both states declined after the 2005 tax reduction, but expressed as a percentage, the border casinos lost fewer revenues than the total state. Because the border casinos exhibit better results than the casinos that do not compete with IL, it seems as though IN and MO are both benefitting from their border casinos stealing customers from IL.

Region-by-Region Breakdown

In order to more closely analyze the changes in the Midwest, the three major regions around IL must be examined: the Northeast, the Southwest, and the South. In addition, the single IL casinos in the Central and Northwest regions will also be reviewed.

Northeast

TABLE 4.13: Independent Variable Summary for **Northeast** IL Region from 2000 to 2007
Equation: state revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	IL	IN	Total
α	91.9	75.3	167.2
β_1	0.4**	0.2**	0.7**
t-stat	(10.9)	(4.0)	(7.6)
m7	105%	105%	105%
β_{2002}	-7.0**	9.3**	2.5
t-stat	(-5.4)	(4.8)	(0.9)
%	-6.8%	9.7%	1.2%
β_{2003}	-14.7**	4.0*	-10.6**
t-stat	(-11.6)	(2.1)	(-3.8)
%	-15.9%	3.9%	-5.4%
β_{2005}	3.2*	-1.3	2.0
t-stat	(2.4)	(-0.7)	(0.7)
%	3.0%	-1.2%	1.0%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

The Northeast IL region is the largest of the three major battles, with $2.6 B in revenues during 2007. There are nine casinos in this area: four on the IL side of the border and five on the IN side. It also exhibits the most telling results, as millions of dollars in revenue shifted from IL

to IN due to the tax increases. From 2000 to mid-2002, IL casinos in the region regularly outgained the IN casinos by $20 M per month. However, following the tax increases, the IN casinos first passed the IL casinos in July 2003 and subsequently remained ahead of IN casinos for the next couple years. Recently, the two regions have earned approximately the same each month, likely due to IL's higher annual growth, nearly doubling that of IN ($5.1 M to $2.8 M per year), allowing IL to catch up to IN's gains from the tax increases.

The 2002 tax increases by both sides led to an increase in revenues of $9.3 M in IN and a decrease of $7.0 M in IL. The region in total gained $2.5 M per month, a narrow 1.2% gain. Upon IL's 2003 tax increase, IL lost an additional $14.7 M in revenues, outpacing IL's increase of $4.0 M. Although IL improved slightly with their 2005 decrease, the state still faced a deficit of nearly $20 M. The region lost 5.4% and gained 1.0% in 2003 and 2005, respectively. On a casino-by-casino basis, the two Majestic Star casinos in Gary, IN showed the greatest improvement, with each earning in excess of 9.8% of projected revenues with the 2002 tax increase and 6.0% with the 2003 increase (see Appendix F for casino results). Conversely, each of the IL casinos suffered revenue declines due to the two tax increase. The two casinos in Joliet, IL faced differing outcomes. The Empress casino fared the best of the four riverboats in IL, with losses of less than $1.3 M (6.5%) with each tax increase. However, its counterpart, Harrah's Joliet Casino, suffered a 14.3% decline in 2002 and a 31.0% decline in 2003. These monthly revenue losses of about $7.6 M could also be attributed to customers choosing the Empress over Harrah's.

Why did the region increase in 2002, lose patrons in 2003, and then subsequently regain customers in 2005? The one-year of results from the 2002 increase may have been too soon for customers to begin to leave due to potential loss of amenities. The $10.6 M regional loss in 2003

certainly can be attributed to a worsened customer experience at the IL casinos. Since the region only improved slightly in 2005 due to the return of IL tax levels to the 2003 rates, previously lost gamblers have not been returning to these casinos. With annual growth rates just 0.3% for the region, it is possible that the total amount of revenues is nearing its peak in Northeast IL / Northwest IN.

Southwest

TABLE 4.14: Independent Variable Summary for **Southwest** IL Region from 2000 to 2007
Equation: state revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	IL	MO	Total
α	21.6	35.5	57.1
β_1	0.1**	0.2**	0.3**
t-stat	(6.4)	(6.2)	(8.6)
m7	104%	103%	103%
β_{2002}	-1.6**	3.3**	1.6
t-stat	(-4.0)	(3.1)	(1.5)
%	-7.1%	7.1%	2.4%
β_{2003}	-1.6**	3.7**	2.1*
t-stat	(-4.1)	(3.6)	(2.0)
%	-7.3%	7.0%	2.8%
β_{2005}	0.4	-1.6	-1.2
t-stat	(1.0)	(-1.5)	(-1.1)
%	1.6%	-2.9%	-1.5%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

The Southwest IL region involves the casinos which are concentrated on the Mississippi River, just outside St. Louis, MO. There are two IL casinos and currently four MO riverboats

with the addition of the Lumiere Place Casino in December 2007. It is the second largest region, just shy of $1 B in revenues during 2007, of which the MO was responsible for 68%. It is also growing at an annual rate of 0.3%. This region as a whole derived the greatest benefits from the changes in tax rates.

Following IL's 2002 tax increase, IL experienced revenue declines, while MO gained. IL lost $1.6 M (7.1%) and MO improved by $3.3 M (7.1%), as the percentages moved in perfect symmetry. The region in total gained 2.4%, although the increase of $1.6 M was not statistically significant. When IL further increased taxes in 2003, IL's revenue losses increased an additional $1.6 M (7.3%) with MO continuing their increases by $3.7 M (7.0%). The region improved an additional 2.8%. MO fared worst when IL decreased their taxes in 2005, as the state suffered a decline of $1.6 M. IL's losses improved slightly by $0.4 M, while the region dropped by $1.2 M (1.5%). Of all the riverboats, the Ameristar St. Charles Casino on the MO side performed best, growing 35.3% and 10.8% upon the two tax increases. The Ameristar opened their $210 M expansion in August 2002, so this is likely a major cause of the vast increases. Even after adjusting for higher revenues due to the expansion, results remained positive at the Ameristar, with increases of 10.5% and 12.6% following the 2002 and 2003 changes (see Appendix F for both Ameristar results). The Harrah's St. Louis Casino exhibited strange results, as revenues dropped nearly 20% in 2002 before improving slightly in both 2003 and 2005. The initial decline in revenue could be attributed to customers instead visiting the Ameristar. The Alton Belle Casino on the IL border fared the worst, suffering losses of 8.6% and 15.5% due to the two tax increases while recouping just 3.2% in response to the 2005 change.

It appears that MO has chosen this area as one that offers great potential in the future. Although the entire region does not have a high growth rate, MO may believe that by stealing

customers from IL and adding additional riverboats (the Lumiere Place Casino), the state can continue to grow its revenues. MO must be careful that it does not expand too rapidly, as Lumiere Place may instead result in customers switching from one MO casino to another.

South

TABLE 4.15: Independent Variable Summary for **South** IL Region from 2000 to 2007
Equation: state revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	IL	IN	MO	Total
α	8.8	23.3	1.7	33.8
β_1	0.1**	0.1**	0.0**	0.2**
t-stat	(7.5)	(6.6)	(6.1)	(8.0)
m7	111%	105%	102%	107%
β_{2002}	-0.4	3.7**	-0.3**	3.0**
t-stat	(-1.1)	(5.1)	(-5.1)	(3.1)
%	-3.0%	11.3%	-19.0%	6.3%
β_{2003}	-0.8*	-0.1	-0.1	-1.0
t-stat	(-2.6)	(-0.1)	(-0.9)	(-1.0)
%	-6.8%	-0.2%	-3.3%	-2.0%
β_{2005}	-0.2	-0.5	0.2**	-0.6
t-stat	(-0.6)	(-0.7)	(3.0)	(-0.6)
%	-1.5%	-1.4%	8.6%	-1.1%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

The region in southern IL is the only region in which all three states compete. The competitors are more distanced than the tightly concentrated Northeast and Southwest regions. Both the MO and IN casinos are located approximately two hours from the Players Riverboat &

Casino in Metropolis, IL. The South region is the fastest growing region surrounding IL, with an annual growth rate of 0.4%, and in 2007 the region earned $0.8 B.

IN was the major beneficiary in 2002 following the tax increases in both IL and IN. The state gained $3.7 M, an 11.3% increase. Conversely, both IL and MO declined by $0.4 M and $0.3 M respectively. Interestingly, all three states declined due to the IL tax increase in 2003, with IL dropping $0.8 M (6.8%), while IN and MO both decreased by $0.1 M. Even after decreasing its taxes in 2005, IL revenues continued declining. IN decreased an additional $0.5 M while MO actually improved by $0.2 M. The region increased by $3.0 M in 2002, with decreases of less than $1.0 M in both 2003 and 2005. MO (Aztar) and IL (Metropolis) each have just one casino in the region, while IN currently has three following its recent addition of French Lick in October 2006. Since its opening came after the tax increases, it was removed from the sample. Smaller than Caesars Indiana, the Casino Aztar (IN) is driving the gains from the tax increases in IN, although the casino's negative trend may be a cause for concern. As evidenced by the opening of the French Lick Resort Casino, IN is focusing on this region as an area for growth and continued gains against lackluster competition from the Players Casino in Metropolis, IL.

Central

TABLE 4.16: Independent Variable Summary for **Central** IL Region from 2000 to 2007
Equation: state revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	IL
α	11.1
β_1	0.0**
t-stat	(3.0)
m7	106%
β_{2002}	0.1
t-stat	(0.6)
%	1.0%
β_{2003}	-1.3**
t-stat	(-5.9)
%	-11.6%
β_{2005}	-0.6*
t-stat	(-2.5)
%	-5.3%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

The lone IL casino in the central part of the state is the Par-A-Dice Riverboat Casino in East Peoria. The casino earned $133 M in 2007 and represented 6.7% of the total AGR received by the state. It has an annual growth rate of less than 0.2%, below every other region. Although this casino was not adversely affected by the 2002 tax increase, its revenues declined $1.3 M due to the 2003 tax increase. Worse, revenues declined an additional $0.6 M after tax rates reverted back to 2005 levels. It is also the only casino which receives very little of its revenues from out-of-state visitors, as it is located in the heart of IL, at least two hours from each border.

Northwest

TABLE 4.17: Independent Variable Summary for **Northwest** IL Region from 2000 to 2007
Equation: state revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	IL
α	2.8
β_1	0.0*
t-stat	(2.4)
m7	106%
β_{2002}	0.2*
t-stat	(2.3)
%	7.2%
β_{2003}	-0.2
t-stat	(-1.6)
%	-4.8%
β_{2005}	-0.3**
t-stat	(-2.9)
%	-9.5%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

The final casino in IL is Jumer's Casino Rock Island, located on the Northwest border. It is surrounded by Iowa riverboats, and its 2007 revenue of $36 M was the least of any IL casino, accounting for less than 2% of total AGR for the year. Similar to the other regions, the Rock Island casino is growing at 0.2% annually. The casino increased its revenues after the first tax increase, declined slighted after the second tax increase, and dropped the most following the tax *decrease*. This pattern differs from the other regions and is contrary to what is expected. However, since each change was less than $0.3 M either way, it is difficult to attribute the changes in revenues to the tax changes. IL has a curious strategy, with just one small riverboat competing against several larger casinos from Iowa. Perhaps IL is testing out different ideas with

Rock Island with the intention of adding more casinos in subsequent years if the region proves to be promising.

Tax Basis

From analysis of the Midwest gambling area and its respective regions, it is apparent that IL casinos lost considerable revenues to casinos in neighboring states such as IN and MO. It is also important to take into account the actual tax revenues received by each state. IL may still judge the apparent negative effects positively if the decreases in AGR were offset by increased tax revenues. Table 4.18 shows the results for the three states and region based on tax revenues. The actual tax revenues per month could not be used because for states with graduated tax structures (IL and IN), the wagering tax in earlier months in the fiscal year (July, August) are taxed at lower rates than the later months (May, June). To adjust for this, the AGR for the month was multiplied by the effective tax rates in Table 4.9 for each fiscal year, resulting in equitable tax rates in each month and comparability. For Jan 2000 to June 2000 and July 2007 to Dec 2007, no fiscal year applies. Since there were no major tax changes in either 2001 or 2007, the effective tax rate in FY2001was used for the first period and the rate in FY2007 was used for the latter period.

TABLE 4.18: Independent Variable **Tax** Summary for IL, IN, MO from 2000 to 2007
Equation: state **tax** revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	IL	IN	MO	Total
α	41.0	36.8	24.5	102.3
β_1	0.3**	0.2**	0.1**	0.6**
t-stat	(13.5)	(7.8)	(7.1)	(11.1)
m7	107%	107%	103%	106%
β_{2002}	5.9**	10.7**	1.5**	18.2**
t-stat	(8.6)	(10.7)	(2.8)	(9.7)
%	9.9%	18.4%	5.1%	12.3%
β_{2003}	4.2**	3.1**	0.9	8.2**
t-stat	(6.4)	(3.2)	(1.7)	(4.5)
%	6.3%	4.7%	2.7%	5.0%
β_{2005}	-12.2**	-0.6	-1.2*	-13.9**
t-stat	(-17.5)	(-0.6)	(-2.2)	(-7.3)
%	-20.0%	-0.8%	-3.5%	-8.4%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

Similar to the analysis of total revenues, IN is the clear winner on the basis of tax revenues, as the combination of increased taxes and more revenues yielded large inflows to the state. Following the IL and IN tax increases in 2002, revenues increased in IN and declined in IL. However, both states benefitted from increased tax income, with IL gaining $5.9 M per month (9.9%) and IN receiving $10.7 M (18.4%). When IL further increased rates in 2003, both states again improved, with IL improving to $4.2 M (6.3%) and IN's take increasing $3.1 M (4.7%). IL could not receive the full benefit of their escalating rates, as revenues dropped significantly, decreasing the base on which the tax is levied. MO showed slight improvements in each year, while the overall region improved by 12.3% and 8.2% in the two years.

The 2005 change by IL proved to be the most interesting. In terms of revenues, IL recouped very few patrons it had previously lost due to the two prior tax increases, while IN and MO dipped slightly in response. As expected, IL's two main competitors decreased in terms of tax revenues, with IL losing $0.6 M (0.8%) and MO declining to $1.2 M (3.5%). Conversely, tax revenues in IL plummeted $12.2 M (20.0%), undermining the effects of the two prior tax increases. The gains from the tax increase of 2003 were completely offset by the loss of customers, particularly once the tax rates reverted back to previous levels.

The Future

The analysis of IL shows that casinos and customers are very sensitive to changes in tax rates. Casinos are directly affected, as they keep less of the revenues than they received before. Customers are indirectly affected by these tax rate changes. In response to lower retention rates, casinos are forced to limit the amenities that they offer. Faced with fewer privileges as before, customers are more likely to gamble at another venue, often crossing state borders in the process. States should be very cautious when adjusting the retention rates of their casinos. Other potential negative effects include reduced incentive for investment and fewer job offerings.

The future of the Midwest region continues to transition. Effective January 1, 2008, IL's indoor-smoking ban prohibited the activity at all nine IL riverboats. The casinos lobbied aggressively, forecasting sharp declines in revenues. State gaming officials cited unofficial surveys disclosing that 60 to 70 percent of gamblers smoked in IL casinos (Torriero, 2008). As a final alternative, the riverboats proposed restricting certain floors to either smoking or non-smoking. The state government would not budge, and after two months, the results have been

drastic. January and February revenues have dropped 18 and 13 percent, respectively, even with an extra day in February due to the leap year.

The actions of states such as IL have significant effects on casino operators. The Riverboat Gambling Act authorized up to ten licenses in IL, and the licenses were quickly distributed. Following the closing of the Silver Eagle in 1997, the state has been without a tenth casino for the past eleven years. Although litigation and strict procedures are partly to blame, one could argue that unfavorable treatment over the past decade makes owning a riverboat casino in IL far less attractive.

5 Conclusion

There are three main hypotheses tested in order to evaluate the free rider problem between states in the context of gambling. First, does the gambling market expand with the introduction of new gaming facilities in neighboring states? From analyzing the Pennsylvania/New Jersey market, it appears as though the market does significantly expand with the new slots at the PA race tracks. The second question is whether or not states are successful in reclaiming revenues that were previously lost to neighboring states. Since NJ revenues declined directly following the introduction of slots in PA, more specifically in Philadelphia, the state seems to be reclaiming revenues from Atlantic City. Lastly, are the effects of tax changes significant in intensely competitive regions? Through the analysis of riverboat performance in Illinois, Indiana, and Missouri, the consequences of tax changes should not be taken lightly by state governments. IL lost significant tax revenues following their tax increases, and its eastern neighbor, IN, has proven to be the main beneficiary.

These important conclusions should be strongly considered by state governments interested in the gambling industry. Introduction of gambling facilities will potentially lead to a market expansion and opportunities to receive tax revenues, an important source of funding in times of rough economic conditions. It is also possible to emulate Illinois and increase taxes on casinos in order to derive short-term tax revenue benefits. However, once changes are in place, the control of the gambling market often leaves the states, instead shifting to the casino operators. The casinos are directly responsible for attracting the customers which lead to revenues for the states. If a casino feels mistreated, it will be less likely to invest its funds to draw additional customers to its site. Instead, an operator may focus its attention on its other properties, which may be located in other states, perhaps even on the border. States who are considering entering the gambling market should be very wary of its decisions, as the extensive ramifications of each choice can potentially lead to sizeable benefits to other states. The free rider problem is certainly prevalent in competitive battles between states in the gambling industry, and knowledgeable states can use this to their advantage in the ongoing battle to accumulate revenues.

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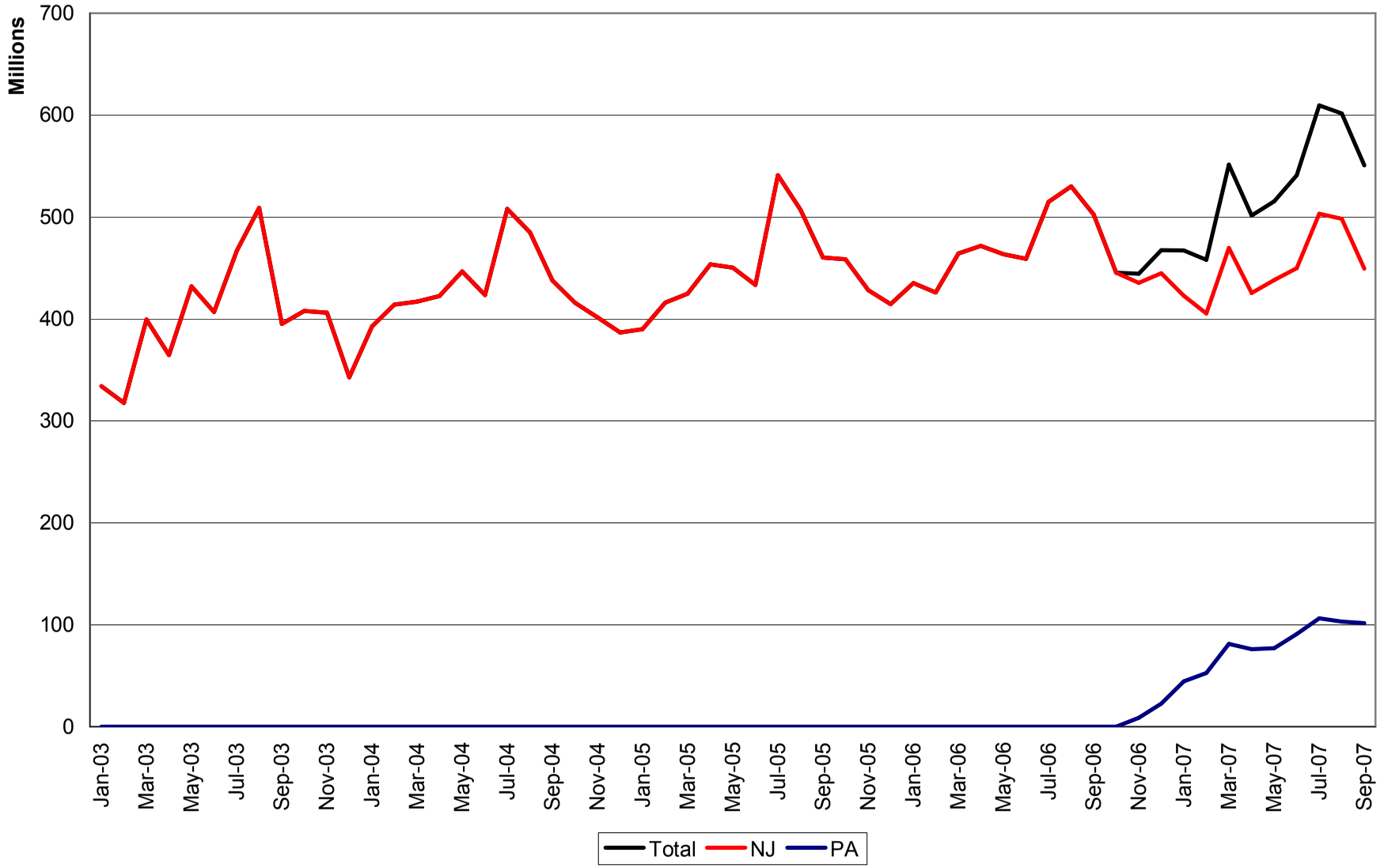
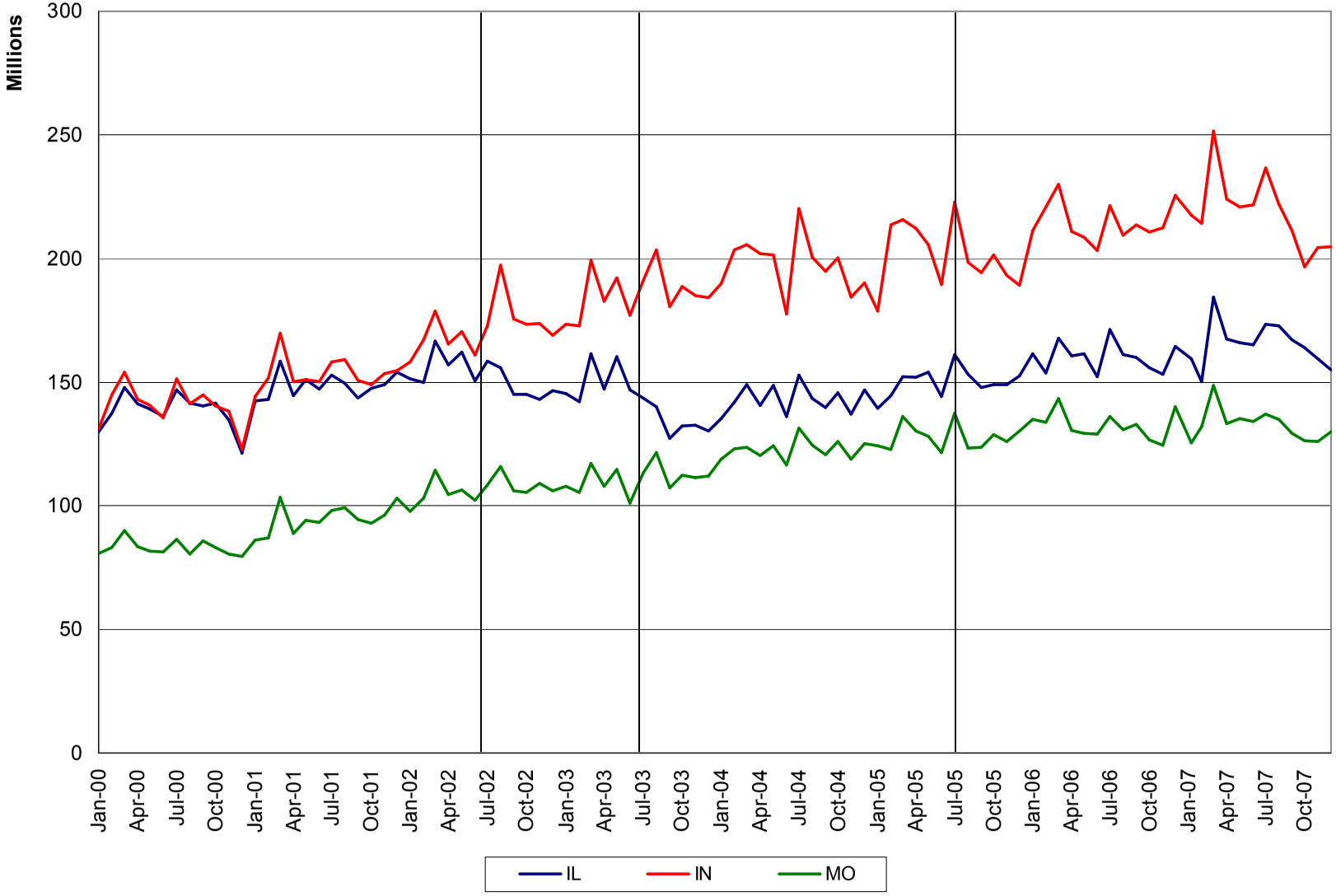
Appendix A: New Jersey and Pennsylvania Adjusted Gross Revenues



Appendix B: Illinois, Indiana, and Missouri Adjusted Gross Revenues



Note: Lines indicate IL and IN tax increase (July 2002), second IL tax increase (July 2003), and IL tax decrease (July 2005).

Appendix C: Tax Rates for Midwest States

ILLINOIS

The pre-1998 wagering tax is as follows:

- 20 percent of AGR
- $2 tax per admission

The 1998 wagering tax rate is as follows:

- 15 percent of AGR up to and including $25 million;
- 20 percent of AGR in excess of $25 million but not exceeding $50 million;
- 25 percent of AGR in excess of $50 million but not exceeding $75 million;
- 30 percent of AGR in excess of $75 million but not exceeding $100 million;
- 35 percent of AGR in excess of $100 million.
- $2 tax per admission

The 2002 wagering tax rate is as follows:

- 15 percent of AGR up to and including $25 million;
- 22.5 percent of AGR in excess of $25 million but not exceeding $50 million;
- 27.5 percent of AGR in excess of $50 million but not exceeding $75 million;
- 32.5 percent of AGR in excess of $75 million but not exceeding $100 million;
- 37.5 percent of AGR in excess of $100 million but not exceeding $150 million;
- 45 percent of the AGR in excess of $150 million but not exceeding $200 million;
- 50 percent of AGR in excess of $200 million.
- $3 tax per admission

The 2003 wagering tax rate is as follows:

- 15 percent of AGR up to and including $25 million;
- 27.5 percent of AGR in excess of $25 million but not exceeding $37.5 million;
- 32.5 percent of AGR in excess of $37.5 million but not exceeding $50 million;
- 37.5 percent of AGR in excess of $50 million but not exceeding $75 million;
- 45 percent of AGR in excess of $75 million but not exceeding $100 million;
- 50 percent of the AGR in excess of $100 million but not exceeding $250 million;
- 70 percent of AGR in excess of $250 million.
- $3 tax per admission up to and including 1 million visitors;
- $4 tax per admission in excess of 1 million visitors but not exceeding 2.3 million;
- $5 tax per admission in excess of 2.3 million visitors

The 2005 wagering tax rate is as follows:

- 15 percent of AGR up to and including $25 million;
- 22.5 percent of AGR in excess of $25 million but not exceeding $50 million;
- 27.5 percent of AGR in excess of $50 million but not exceeding $75 million;
- 32.5 percent of AGR in excess of $75 million but not exceeding $100 million;
- 37.5 percent of AGR in excess of $100 million but not exceeding $150 million;
- 45 percent of the AGR in excess of $150 million but not exceeding $200 million;
- 50 percent of AGR in excess of $200 million.
- $3 tax per admission

INDIANA

The pre-2002 (7/1) wagering tax is as follows:

- 20 percent of AGR.
- $3 tax per admission

The 2002 (7/1) wagering tax rate is as follows:

- 15 percent of AGR up to and including $25 million;
- 20 percent of AGR in excess of $25 million but not exceeding $50 million;
- 25 percent of AGR in excess of $50 million but not exceeding $75 million;
- 30 percent of AGR in excess of $75 million but not exceeding $150 million;
- 35 percent of AGR in excess of $150 million.
- $3 tax per admission

MISSOURI

Flat 20% tax of AGR
$2 tax per admission

NEW JERSEY

Flat 8% tax of AGR to Casino Revenue Fund
Flat 1.25% tax of AGR to Casino Reinvestment and Development Authority

PENNSYLVANIA

Flat 34% tax of AGR to the state
Flat 12% tax of AGR to the Penn Race Horse Development Fund
Flat 5% tax of AGR to Gaming Economic Development and Tourism,
Flat 4% tax of AGR to local community

Appendix D: Calculation of NJ Forecasts (AC Hilton)

TABLE D.1: AC Hilton Seasonal Coefficients
(figures in percents)

Month	Seasonal Coefficient
January	89.8
February	90.4
March	102.1
April	98.5
May	107.2
June	106.4
July	110.5
August	114.9
September	102.6
October	92.7
November	93.2
December	91.7

NOTE: 100% is an average month.
Data from 2000 - 2006 used to calculate coefficients

TABLE D.2: AC Hilton Regression Results 2000 to 2006
Estimated Equation: Monthly AC Hilton Revenues = $\alpha + \beta_1 * t + \varepsilon_i$

Years	α	β_1
2000-2006	26.4	0.0
	(36.8)	(-1.2)

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
Multiplicative seasonal decomposition adjusted the data for monthly seasonality.
t is the trend; t = 0 for January 2000, t = 84 for December 2006.

TABLE D.3: 2007 Forecast of New Jersey Casino Revenues by Month
Eqn: Predicted Monthly AC Hilton Revenues = (26.4 + -0.02 * t) * S_{month}
(figures in $ millions)

t	Month	Actual	Predicted	Difference	%
85	January	25.0	22.4	2.5	11.4
86	February	23.4	22.6	0.8	3.7
87	March	26.5	25.5	1.0	4.1
88	April	26.5	24.5	1.9	7.9
89	May	24.7	26.7	-2.1	-7.7
90	June	25.7	26.5	-0.8	-3.1
91	July	28.9	27.5	1.4	5.0
92	August	30.5	28.6	2.0	6.9
93	September	25.6	25.5	0.1	0.6
94	October	22.6	23.0	-0.4	-1.8
95	November	23.5	23.1	0.4	1.6
96	December	22.1	22.7	-0.6	-2.7
Totals		**304.9**	**298.6**	**6.3**	**2.1**

NOTE: Predicted revenues forecasted using monthly data from 2000 to 2006.
S_{month} represents multiplicative seasonal coefficient (Table D.1)

Appendix E: Calculation of Midwest Coefficients (Illinois)

TABLE E.1: Illinois Seasonal Coefficients
(figures in percents)

Month	Seasonal Coefficient
January	98.1
February	97.8
March	108.1
April	101.1
May	103.8
June	98.0
July	105.1
August	100.5
September	97.0
October	97.4
November	95.1
December	98.1

NOTE: 100% is an average month.
Data from 2000 - 2007 used to calculate coefficients

TABLE E.2: Illinois Independent Variable Summary
Equation: IL revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Years	α	β_1	β_{2002}	β_{2003}	β_{2005}
2000-2007	136.2	0.6**	-8.6**	-18.6**	2.6
	(119.1)	(11.1)	(-4.7)	(-10.5)	(1.4)

t-statistics in parentheses. Figures in $ millions. * sig at 5%. ** sig at 1%.
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
t is the trend; t = 0 for January 2000, t = 96 for December 2007.

TABLE E.3: Percent Change Calculation for IL with the three tax changes

Equation: IL revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	2002	2003	2005
α	136.2	136.2	136.2
t	0.6	0.6	0.6
n	31	43	67
m7	105%	105%	105%
β_{200x}	-8.6	-18.6	2.6
Proj July rev	153.9	141.9	160.0
%	-5.6%	-13.1%	1.6%

coefficients in $ millions per month. t-statistics in parentheses

m7 represents seasonal coefficient for July (100% is average)

Proj July rev = $(\alpha + t * n + B_{200x}) * m7$

Proj July rev for B_{2003} includes $B_{2002;}$ similarly, B_{2005} includes B_{2003} and B_{2002} as the dummy variables were turned on until n = 96, so should be included.

D_{200x} represents dummy variable which turns on in the first month of the tax change

% represents B_{200x} / Proj July rev

Appendix F: Midwest Casino Regression Results

TABLE F.1: Independent Variable Summary for Northeast IL Casinos from 2000 to 2007
Equation: revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	Elgin	Aurora	Joliet-Empress	Joliet-Harrah's
α	32.1	17.8	20.4	21.6
β_1	0.1**	0.1**	0.0	0.2**
t-stat	(7.3)	(8.4)	(1.1)	(11.7)
m7	103%	106%	107%	104%
β_{2002}	-4.2**	2.0**	-1.2*	-3.6**
t-stat	(-8.3)	(5.1)	(-2.3)	(-6.2)
%	-12.9%	8.2%	-5.8%	-14.3%
β_{2003}	-0.7	-6.3**	-1.3*	-6.5**
t-stat	(-1.4)	(-16.5)	(-2.6)	(-11.6)
%	-2.1%	-33.4%	-6.5%	-31.0%
β_{2005}	-0.5	0.6	1.4**	1.7**
t-stat	(-1.0)	(1.6)	(2.7)	(2.9)
%	-1.5%	2.9%	6.5%	6.1%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

TABLE F.2: Independent Variable Summary for Northwest IN Casinos from 2000 to 2007
Equation: revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	Horseshoe	Resorts	Majestic Star I	Majestic Star II	Blue Chips
α	18.9	20.7	10.0	10.7	15.0
β_1	0.2**	0.1**	-0.0	-0.0**	0.0
t-stat	(6.0)	(3.0)	(-0.6)	(-2.7)	(0.9)
m7	105%	104%	102%	103%	109%
β_{2002}	3.1**	1.1	1.7**	1.1**	2.4**
t-stat	(3.2)	(1.5)	(6.1)	(3.1)	(2.9)
%	10.7%	4.3%	14.6%	9.8%	12.0%
β_{2003}	0.7	0.7	0.7**	1.4**	0.5
t-stat	(0.7)	(0.9)	(2.7)	(4.2)	(0.7)
%	2.1%	2.5%	6.0%	11.4%	2.6%
β_{2005}	-0.7	-1.8*	-0.5	-0.7*	2.3**
t-stat	(-0.7)	(-2.4)	(-1.8)	(-2.0)	(2.8)
%	-2.0%	-6.7%	-4.5%	-6.5%	9.8%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

TABLE F.3: Independent Variable Summary for Southwest IL Casinos from 2000 to 2007
Equation: revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	Alton	East St. Louis
α	9.3	12.3
β_1	0.0**	0.0**
t-stat	(7.9)	(3.7)
m7	106%	102%
β_{2002}	-0.9**	-0.8*
t-stat	(-5.8)	(-2.0)
%	-8.6%	-5.9%
β_{2003}	-1.4**	-0.2
t-stat	(-9.7)	(-0.6)
%	-15.5%	-1.8%
β_{2005}	0.3**	0.1
t-stat	(2.2)	(0.2)
%	3.2%	0.6%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

TABLE F.4: Independent Variable Summary for East MO Casinos from 2000 to 2007
Equation: revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	Ameristar	Ameristar (exp)	Harrah's	President
α	10.2	10.4	19.7	5.6
β_1	0.1**	0.1**	0.1**	0.0
t-stat	(4.3)	(4.4)	(6.7)	(1.4)
m7	103%	105%	106%	99%
β_{2002}	7.2**	1.5**	-4.0**	0.1
t-stat	(12.1)	(3.0)	(-7.4)	(0.4)
%	35.3%	10.5%	-19.9%	1.8%
β_{2003}	2.6**	2.3**	1.5**	-0.4
t-stat	(4.5)	(4.5)	(2.9)	(-1.4)
%	10.8%	12.6%	6.5%	-6.2%
β_{2005}	-1.2*	-0.9	0.3	-0.7*
t-stat	(-2.0)	(-1.8)	(0.5)	(-2.4)
%	-4.9%	-4.9%	1.0%	-12.3%

Ameristar represents no adjusment for expansion; Ameristar (exp) adjusts for expansion
coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

TABLE F.5: Independent Variable Summary for South Region Casinos from 2000 to 2007
Equation: revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	IL-Metropolis	IN-Aztar	IN-Caesars	MO-Aztar
α	8.8	8.1	15.2	1.7
β_1	0.1**	-0.0	0.2**	0.0**
t-stat	(7.5)	(-1.4)	(9.4)	(6.1)
m7	111%	106%	104%	102%
β_{2002}	-0.4	1.6**	2.1**	-0.3**
t-stat	(-1.1)	(6.4)	(3.8)	(-5.1)
%	-3.0%	16.0%	9.1%	-19.0%
β_{2003}	-0.8*	0.9**	-1.0	-0.1
t-stat	(-2.6)	(3.6)	(-1.8)	(-0.9)
%	-6.8%	8.0%	-4.0%	-3.3%
β_{2005}	-0.2	0.4	-1.0	0.2**
t-stat	(-0.6)	(1.6)	(-1.8)	(3.0)
%	-1.5%	3.8%	-3.7%	8.6%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

TABLE F.6: Independent Variable Summary for Other IL Casinos from 2000 to 2007
Equation: revenues = $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \varepsilon_i$

Variable	East Peoria (Central)	Rock Island (Northwest)
α	11.1	2.8
β_1	0.0**	0.0*
t-stat	(3.0)	(2.4)
m7	106%	106%
β_{2002}	0.1	0.2*
t-stat	(0.6)	(2.3)
%	1.0%	7.2%
β_{2003}	-1.3**	-0.2
t-stat	(-5.9)	(-1.6)
%	-11.6%	-4.8%
β_{2005}	-0.6*	-0.3**
t-stat	(-2.5)	(-2.9)
%	-5.3%	-9.5%

coefficients in $ millions per month. t-statistics in parentheses. * sig at 5%. ** sig at 1%.
% represents coefficient divided by predicted revenues in first month of tax increase
data decomposed multiplicatively to adjust for monthly seasonality
D_{200x} represents dummy variable which turns on in the first month of the tax change
m7 represents seasonal coefficient for July (100% is average)

Appendix G: Caesars and Ameristar Calculation

TABLE G.1: Caesars Indiana Seasonal Coefficients
(figures in percents)

Month	Seasonal Coefficient
January	95.5
February	103.0
March	109.6
April	98.8
May	100.7
June	96.5
July	104.3
August	102.0
September	98.5
October	99.3
November	97.1
December	94.8

NOTE: 100% is an average month.
Data from 2000 - 2007 used to calculate coefficients

TABLE G.2: Caesars Indiana Independent Variable Summary
Dependent Variable - Caesars Indiana monthly revenue
Eqn: $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \beta flood * flood + \varepsilon_i$

Years	α	β_1	β_{2002}	β_{2003}	β_{2005}	$\boldsymbol{\beta_{flood}}$
2000-2007	15.2	0.2**	2.1**	-0.9	-0.9	**-7.7****
	(43.8)	(9.2)	(3.8)	(-1.8)	(-1.6)	(-6.0)

t-statistics in parentheses. Figures in $ millions. * sig at 5%. ** sig at 1%.
data decomposed multiplicatively to adjust for monthly seasonality
t is the trend; t = 0 for January 2000, t = 96 for December 2007.
D_{200x} represents dummy variable which turns on in the first month of the tax change
flood represents dummy variable for Jan-05 when flooding closed casino for 10 days

TABLE G.3: Ameristar St. Charles Casino Seasonal Coefficients
(figures in percents)

Month	Seasonal Coefficient
January	99.9
February	98.6
March	107.9
April	98.8
May	101.4
June	96.0
July	103.2
August	101.2
September	99.0
October	97.2
November	97.0
December	99.7

NOTE: 100% is an average month.
Data from 2000 - 2007 used to calculate coefficients

TABLE G.4: Ameristar St. Charles Casino Independent Variable Summary
Dependent Variable - Ameristar monthly revenue
Eqn: $\alpha + \beta_1 * t + \beta_{2002} * D_{2002} + \beta_{2003} * D_{2003} + \beta_{2005} * D_{2005} + \beta_{expansion} * expansion + \varepsilon_i$

Years	α	β_1	β_{2002}	β_{2003}	β_{2005}	$\boldsymbol{\beta_{expansion}}$
2000-2007	10.3	0.1**	1.4	2.2**	-1.1	**6.4****
	(31.2)	(4.5)	(1.2)	(4.2)	(-2.0)	(5.1)

t-statistics in parentheses. Figures in $ millions. * sig at 5%. ** sig at 1%.
data decomposed multiplicatively to adjust for monthly seasonality
t is the trend; t = 0 for January 2000, t = 96 for December 2007.
D_{200x} represents dummy variable which turns on in the first month of the tax change
expansion represents dummy variable for Aug-02 onwards following the $210 expansion